Claims:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (Previously presented) A system for delivering a desired mass of gas, comprising:

a chamber;

a first valve controlling gas flow into the chamber;

a second valve controlling gas flow out of the chamber;

a pressure transducer providing measurements of pressure within the chamber;

a controller connected to the valves and the pressure transducer, wherein the controller is configured and arranged to

(i) receive a desired mass flow setpoint from an input device;

(ii) close the second valve;

(iii) open the first valve;

(iv) receive chamber pressure measurements from the pressure transducer;

(v) close the first valve when pressure within the chamber reaches a predetermined level;

(vi) wait a predetermined waiting period to allow the gas inside the chamber to approach a state of equilibrium;

(vii) open the second valve at time = t_0;

(viii) calculate a value of the total mass delivered when the second valve is open and as a function of temperature and pressure within the chamber; and

(ix) close the second valve at time = t* when the calculated value of total mass delivered equals the desired mass flow setpoint, wherein t* is from about 100 milliseconds to about 500 milliseconds.

2. (Previously presented) A system according to claim 1, wherein the mass delivered Δm at time t* is equal to,

$$\Delta m = m(t_0) - m(t^*) = (V/R)[(P(t_0)/T(t_0)) - (P(t^*)/T(t^*))]$$

wherein $m(t_0)$ is the mass of the gas in the chamber at time = t_0 when the gas inside the chamber is at a state of equilibrium, $m(t^*)$ is the mass of the gas in the chamber at time = t*, V is the volume of the chamber, R is equal to the ideal gas constant (J/ Kg K), $P(t_0)$ is the pressure in the chamber at time = t_0, $P(t^*)$ is the pressure in the chamber at time = t*, $T(t_0)$ is the temperature in the chamber at time = t_0, and $T(t^*)$ is the temperature in the chamber at time = t*.

3. (Previously presented) A system according to claim 2, further comprising a temperature probe secured to the chamber and connected to the controller, wherein the temperature probe provides $T(t_0)$ and $T(t^*)$ to the controller.

4. (Previously presented) A system according to claim 3, wherein the chamber includes a chamber wall, and wherein $T(t_0)$ and $T(t^*)$ are calculated by the controller using:

$$dT/dt = -(\rho_{STP}/\rho V)Q_{out}(\gamma-1)T + (Nu\ \kappa/l)(A_w/VC_v\rho)(T_w - T)$$

wherein ρ_{STP} is the gas density under standard temperature and pressure (STP) conditions, ρ equals the density of the gas, V is the volume of the chamber, Q_{out} is the gas flow out of the chamber, T equals absolute temperature, γ is the ratio of specific heats, Nu is Nusslets number, κ is the thermal conductivity of the gas, C_v is the specific heat of the gas under constant volume, l is the characteristic length of the chamber, and T_w is the temperature of the wall of the chamber as provided by the temperature probe.

5. (Previously presented) A system according to claim 4, wherein the gas flow out of the chamber is calculated using:

$$Q_{out} = -(V/\rho_{STP})[(1/RT)(d\rho/dt)-(P/RT^2)(dT/dt)]$$

6. (Previously presented) A system according to claim 1, wherein the value of the predetermined level of pressure is provided through the input device.

7. (Previously presented) A system according to claim 1, wherein the value of the predetermined waiting period is provided through the input device.

8. (Previously presented) A system according to claim 1, further comprising an output device connected to the controller, and wherein the controller is configured and arranged so as to provide to the output device an indication of the mass delivered.

9. (Previously presented) A system according to claim 1, wherein the chamber is a delivery chamber, further comprising a process chamber connected to the delivery chamber through the second valve.

10. (Original) A system according to claim 1, wherein the pressure transducer has a response time of about 1 to 5 milliseconds.

11. (Original) A system according to claim 1, wherein the second valve has a response time of about 1 to 5 milliseconds.

12.-20. (Canceled)

21. (Previously presented) A system for delivering a desired quantity of mass of gas, comprising:

a chamber including an inlet and outlet;

an inlet valve, connected to the inlet, configured and arranged so as to control the flow

of gas into the chamber through the inlet;

an outlet valve, connected to the outlet, configured and arranged so as to control the flow of gas from the chamber through the outlet; and

a controller configured and arranged to control the inlet and outlet valves so that (a) gas can flow into the chamber until the pressure within the chamber reaches a predetermined level, (b) the pressure of gas within the chamber can reach a state of equilibrium, and (c) a controlled amount of mass of the gas can then be measured when the outlet valve is open and allowed to flow from the chamber as a function of a setpoint corresponding to a desired mass, and the temperature and pressure in the chamber, wherein for delivery of the mass of gas, the outlet valve is open for a time of about 100 milliseconds to about 500 milliseconds.

22. (Previously presented) A system according to claim 21, further including a pressure sensor constructed and arranged so as to provide a pressure measurement signal to the controller as a function of the pressure within the chamber, and a temperature sensor constructed and arranged so as to provide a temperature measurement signal to the controller as a function of the temperature within the chamber.

23. (Previously presented) A system according to claim 21, wherein the amount of mass of gas flowing from the chamber, Δm at time t^*, is determined by the controller as follows:

$$\Delta m = m(t_0) - m(t^*) = (V/R)[(P(t_0)/T(t_0)) - (P(t^*)/T(t^*))],$$

wherein $m(t_0)$ is the mass of the gas in the chamber at time = t_0 when the gas within the chamber is at a state of equilibrium, $m(t^*)$ is the mass of the gas in the chamber at time = t^*, V is the volume of the chamber, R is equal to the ideal gas constant (J/ Kg-K), $P(t_0)$ is the pressure in the chamber at time = t_0, $P(t^*)$ is the pressure in the chamber at time = t^*, $T(t_0)$ is the temperature in the chamber at time = t_0, $T(t^*)$ is the temperature in the chamber at time = t^*.

24. (Previously presented) A system according to claim 21, wherein the controller is

further configured and arranged to control operation of the inlet valve by control commands.

25. (Previously presented) A system according to claim 21, wherein the chamber includes a chamber wall, and further comprising a temperature sensor configured and arranged to sense a temperature of the chamber wall T_w, and produce a corresponding temperature signal, and wherein $T(t_0)$ and $T(t^*)$ are the measured temperatures of the chamber wall at times t_0 and t^*, respectively.

26. (Previously presented) A system according to claim 25, wherein the controller is configured and arranged so that a controlled amount of mass of the gas can be allowed to flow from the chamber as a function a time derivative of the temperature $dT/dt = -(\rho_{STP}/\rho V)Q_{out}(\gamma\text{-}1)T + (Nu\ \kappa/l)(A_w/VC_v\rho)(T_w - T)$, wherein ρ_{STP} is the gas density under standard temperature and pressure (STP) conditions, ρ equals the density of the gas, V is the volume of the chamber, Q_{out} is the gas flow out of the chamber, T equals absolute temperature, γ is the ratio of specific heats, Nu is Nusslets number, κ is the thermal conductivity of the gas, C_v is the specific heat of the gas under constant volume, l is the characteristic length of the chamber, and T_w is the temperature of the wall of the chamber as provided by the temperature sensor.

27. (Previously presented) A system according to claim 21, wherein the outlet valve has a response time of about 1 ms to about 5 ms.

28. (Previously presented) A system according to claim 21, wherein the response time of the outlet valve is about 2 ms to about 5 ms.

29. (Previously presented) A system according to claim 21, wherein the pressure sensor has a response time of about 1 ms to about 5 ms.

30 (Previously presented) A system according to claim 21, wherein the chamber is a delivery chamber, and further comprising a process chamber connected to the delivery chamber through the outlet valve.

31.-53. (Canceled)